CARBON FIXED IN LEAVES AND TWIGS OF FIELD *LARREA TRIDENTATA* IN TWO-HOUR EXPOSURE TO $^{14}CO_2$

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Abstract.— Six *Larrea tridentata* (Sesse & Moc. ex DC) Cov. plants were exposed to $^{14}CO_2$ in a field experiment r 2 h. Three of the plants had been irrigated regularly in the preceding year. Ten small twigs from each plant were moved and counted for ^{14}C activity at the end of 2 h. The stem portion of the twigs was of equal dry weight for he two sets of plants, but those irrigated had a greater weight of leaves per twig. The activity of ^{14}C in leaves was qual for the two groups, but was higher in stems for watered plants than for unwatered plants. The results were est expressed as ratios. Dry weight of leaves ÷ dry weight of stems was high for watered plants; cpm/g dry weight leaves ÷ cpm/g dry weight of stems was higher for unwatered plants. In another experiment in which leaves ere removed before exposing stem portions of twigs to $^{14}CO_2$, small green stems accounted for about 1/8 the total hotosynthesis for a plant; the coefficient of variation was around 100 percent.

Introduction

Larrea tridentata (Sesse & Moc. ex DC) Cov. is a perennial well adapted to the hot, ry summers of the Mojave Desert. It is a C-3 lant with a relatively low rate of photo- nthesis (Barbour, 1977). It is an evergreen ith an ability to fix CO_2 in every month of he year (Bamberg et al. 1973, 1975). Its naller stems have chlorophyll, particularly oung stems, and they also are capable of hotosynthesis. The purpose of this report as to show the relative importance of leaves nd stems for photosynthesis of this species in he field in the northern Mojave Desert. Part f the plants used in this study were also in- olved in a shoot-root carbon budget study Wallace et al. 1980, this volume) and data ere available from which the present results ere obtained.

Materials and Methods

Six *L. tridentata* were exposed to $^{14}CO_2$ for h on the morning of 14 May 1974 by tech- iques previously used (Bamberg et al. 1973, 974; Wallace et al. 1977). Briefly, 5 ml of a .5 *M* solution of $KH^{14}CO_3$ was mixed with ICl inside a plastic bag which was tied at he base of the plant. The ^{14}C activity was 5 Ci/ml. After exposure the bags were re- moved, and ten small twigs containing leaves and stems were removed from each plant and assayed with Q-gas counting for ^{14}C fixed. Each leaf and stem sample was counted in triplicate. Three of the six plants used had been irrigated regularly in the previous year. Since translocation from leaves to twigs was possible during the 2-h test, a second experi- ment was conducted in which leaves were first removed from green stems. These stems were then subjected to the same type of test as twigs previously.

Results and Discussion

The weight of leaves per twig was higher for the three plants previously irrigated than for those not irrigated (Table 1). The coefficient of variation (C.V.) for within the watered plants was low enough to indicate that that group was a separate population. The weights of stems per twig, however, were similar for both groups of plants.

The amount of ^{14}C fixed per g dry weight of both leaves and stems was variable with a C.V. of about 100 percent. However, for leaves the means of each group were essen- tially identical. For stems the watered plants had about 60 percent more ^{14}C than the non- watered plants (Table 1). When the data were considered as ratios with cpm/g dry

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weight of leaves ÷ the cpm/g dry wt of stems (Table 2) it is apparent that this observation is statistically significant. The C.V. for ratios with unwatered plants was only 7.6 percent and only 5.5 percent for watered plants. When all six plants were grouped together the C.V. was 23.8 percent.

The ratio of dry weight of leaves to dry weight of stems was 40 percent larger for the watered plants than for the nonwatered ones. The C.V. of both groups was low (1.7 and 13.2 percent), indicating that they are separate populations. The previous irrigation then was reflected in a larger growth of leaves on the plants.

In the second experiment in which leaves had been removed from green stems before the $^{14}CO_2$ was started, it was shown that approximately ⅛ (the coefficient of variation was around 100 percent) of the photosynthesis for *L. tridentata* could be by way of the green stems (Table 3). On the dry weight basis the amount of ^{14}C in green stems was 51 percent that of leaves. Green stems with leaves attached contained more ^{14}C than did green stems with leaves removed, so it can be assumed that there was some translocation from leaves to stems during the 2 h test. There was also some ^{14}C translocated to small branches during the 2 h.

Stem photosynthesis is very likely one of the adaptive mechanisms of this drought-tolerant, heat-resistant desert plant species.

TABLE 1. Dry weight of twigs and ^{14}C in twigs of *L. tridentata* exposed for 2 h to $^{14}CO_2$.

	Dry wt of twigs		^{14}C	
	Leaves	Stems	Leaves	Stems
	mg/twig		cpm/g dry wt	
	Unwatered (n = 3)			
Mean	67.1	29.8	67547	41900
S.D.	19.4	8.3	59103	33710
C.V.%	28.9%	27.7%	87.5%	80.5%
	Watered (n = 3)			
Mean	85.2	27.1	69753	66380
S.D.	9.4	1.4	72615	66021
C.V.%	11.1%	5.2%	104.1%	99.5%
	All plants (n = 6)			
Mean	76.2	28.5	68650	54140
S.D.	16.9	5.5	59227	48763
C.V.%	22.2%	19.3%	86.3%	90.1%

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TABLE 2. Ratios of leaf and stem portions of the twigs for dry weight and ^{14}C fixed in *L. tridentata*.

	Dry wt of leaves / Dry wt of stems	cpm/g dry wt leaves / cpm/g dry wt stems	cpm/twig-leaves / cpm/twig-stems
	Ratio	Ratio	Ratio
	Unwatered (n = 3)		
Mean	2.26	1.56	3.49
S.D.	0.038	0.12	0.21
C.V.%	1.7%	7.6%	6.0%
	Watered (n = 3)		
Mean	3.18	1.02	3.19
S.D.	0.42	0.056	0.30
C.V.%	13.2%	5.5%	9.3%
	All plants (n = 6)		
Mean	2.71	1.29	3.34
S.D.	0.58	0.31	0.28
C.V.%	21.3%	23.8%	8.5%

TABLE 3. ^{14}C fixation of green stems of *L. tridentata* from which leaves had been removed compared with stems with leaves attached.*

	Relative Dry wt	^{14}C cpm/g	CV %	Relative cpm/g
Leaves	1.00	88,127	88.0	1.00
Green stems (leaves attached)	0.45	45,233	104.0	0.51
Small branches	0.26	13,773	72.4	0.16
Green stems (without leaves attached)	0.45	32,910	114.1	0.37

*Relative photosynthesis for the green stems for the per plant basis would be (0.45 × 0.37) + 1 + (0.45 × 0.51) + (0.26 × 0.16) = 0.434 or about ⅛. All values in the calculation are in Table 3. Since the CV is around 100%, its value of ⅛ must be considered also as possibly in error by as much as 100%.

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